REMARKS

The only remaining issue in this case is eligibility under 35 USC § 101. Claims 1, 4-41, and 43-47 stand rejected under 35 U.S.C. §101 as directed to non-statutory subject matter. The Examiner has indicated that the aforementioned claims define allowable subject matter under §§102, 103, and 112, but that he reserves a statement of reasons for allowance "until the issues under 35 U.S.C. §101 have been resolved." Resolution of this issue is now sought. The Applicant seeks to amend the claims to alleviate the § 101 issue in this Response.

Although it is asserted that the finite element simulation recited in the claims prior to this Response is eligible subject matter under § 101, certain of the claims are currently amended to remove any doubt that the finite element simulation of the claims accomplishes a practical application rather than simply being directed towards an abstract mathematical concept.

If, however, the current amendments are deemed insufficient to overcome the rejections under § 101, then Applicant wishes to preserve the right to use the claims present in the Response dated November 3, 2005 for purposes of appeal.

Although it is asserted that a finite element simulation in and of itself is useful and not simply an abstract algorithm or mathematics, and therefore eligible, claim 1 has been amended as follows to alleviate the concerns in this regard. Claim 1 is currently amended as follows.

1. A computer implemented method of simulating the effect of a load or other influence on a system, comprising performing a finite element simulation comprising automatically switching between an implicit method of analyzing the effect of the load or other influence, and an explicit method of analyzing the effect of the load or other influence, two or more times during the finite element simulation. (additions underlined, deletions omitted)

As can be seen, the claim has been amended to recite that the method is of "simulating the effect of a load or influence on a system." The process of simulating and the related simulation is a useful and "concrete" result. With such a simulation, an engineer can improve

the design of a product or gain insight into a process that may otherwise not be possible without the simulation.

Furthermore, the claim has been amended to make a connection with the implicit method and explicit methods that are utilized in the overall involved method of simulating. Claim 1 now recites "automatically switching between an implicit method of analyzing the effect of the load or other influence, and an explicit method of analyzing the effect of the load or other influence." This makes it abundantly clear that the implicit and explicit methods are tied in with producing the concrete and tangible result, which is the simulation. Finite element simulation, and the methods involved in the same, are not simply abstract math or mathematical algorithms, as asserted by the Examiner. While there is no doubt that mathematics is involved in finite element simulations and methods, the math is a means to an end. The calculations are what underpin and create the simulation and make it possible, but the end product, the simulation (and methods of performing same) is something quite useful. Again, this is why engineers perform the finite element simulations regularly.

The current amendments to the body also indicate that the implicit and explicit methods are used in "analyzing the effect of the load or other influence." This analyzing is part of simulating the effect of the load or other influence. Both "simulating the effect of a load or other influence on a system" and "analyzing the effect of the load or other influence" are useful and therefore eligible subject matter. In other words, they produce or are directed towards producing a useful, concrete and tangible result: a finite element simulation (or method for same). This is not an abstract idea, law of nature or a natural phenomena, that 35 U.S.C. § 101 seeks to exclude from eligibility for patent protection. Nor is the claimed method, as in the original or as amended, "merely a statement of the abstract idea to modify the prior art finite element simulation," as asserted by the Examiner at page 4 of the Office Action dated 03/07/2006. This will be illustrated in a discussion of the "real world value" of the claimed invention in more detail below.

If the Examiner is of the belief that this or any of the pending claims do not cover a finite element simulation (or computer system, method, or data signal related to the same), contrary to the plain language of the claims, he is kindly requested to state so and explain why.

If, the Examiner is of the belief that the pending claims *do* relate to or cover a finite element simulation (or computer system, method, or data signal related to the same), but that the simulation (or computer system, method, or data signal related to the same) is nevertheless still not directed towards eligible subject matter, he is requested to explain the disconnect.

Claim 14 has been amended in a similar fashion to claim 1 and is reproduced below.

14. A computer readable storage medium storing one or more computer programs for simulating the effect of a load or other influence on a system by performing a finite element simulation, the computer programs comprising instructions for automatically switching between an implicit method of analyzing the effect and an explicit method of analyzing the effect two or more times during the finite element simulation.

It is therefore submitted that claim 14 and the claims that depend therefrom also comprise eligible subject matter and are fully in compliance with § 101 for the reasons given above regarding claim 1. Regarding claims 14 and 25, the Examiner indicates that the invention is tangibly embodied but does not produce a useful, concrete, and tangible result because, among other things, the claim "does not recite that the computer programs are actually executed..." *See* Office Action dated 03/07/2006 at 4-5. One of skill in the art understands that computer software is made to be executed, and execution need not be recited in the claim in order for the claim to have utility, contrary to the Examiner's assertion. Likewise, the simulation performed on the computer system recited in claim 25, and the claims that depend therefrom, is also asserted to be fully in compliance with § 101.

Regarding independent claim 36, the Examiner indicates "a data signal embodied in a carrier wave" is not a proper tangible embodiment because "the claim is strictly limited to describing the physical characteristics of a carrier wave. The claim recites no transmitters, no receivers, no method for employing the carrier wave to achieve a result, etc." Id. at 5-6.

As for the Examiner's issue with the lack of transmitter or receivers, they are simply not required. Subsequent to *Beauregard* and the PTO examination guidelines now found in section 2106 of the MPEP, In Appeal No. 2,002-1554 in the case of *Ex parte Rice* (Application 08/003,996) the BPAI reversed an examiner's rejection of signal claims as being directed to non-statutory subject matter under 35 U.S.C. § 101, holding that electromagnetic signals, although

"transitory and ephemeral in nature," are statutory subject matter. *See e.g. Ex parte Rice. See also In re Beauregard*, 53 F.3d 1583 (Fed. Cir. 1995) and MPEP section 2106.

As an interesting note, the precedent for eligibility of claims relating to electromagnetic signals without (requirements of) transmitters and receivers, has a long history and stems in part from the patents to Samuel Morse, inventor of the telegraph. *See O'Reilly v. Morse*, 56 U.S. at 114-19.[1]

As for independent claim 47, it has been amended to recite that it is a computer implemented method for performing a finite element simulation. Such a method is eligible for the reasons given above regarding claim 1, and for the reasons given below, which are given in support of all of the pending claims.

Factual Support of Real World Value of All Pending Claims

The Examiner has encouraged the Applicant to find factual support in their arguments in MPEP 2106 and has informed the Applicant that "unsupported arguments and hyperbole of the type submitted in the previous response will be unlikely to overcome the bases of these rejections." *See* Office Action dated 03/07/2006 at 6.

Section 2106(II) of the MPEP, as cited by the Examiner, begins by stating the basic test for eligible subject matter (bold emphasis added):

> [t]he claimed invention as a whole must accomplish a **practical application**. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of **"real world" value, as opposed to subject matter that represents nothing more than an idea or concept**, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)).

[1] As Morse stated "I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specifications and claims. The essence of my invention being the use of motive power of the electric or galvanic current, which I call electromagnetism, however developed for making or printing intelligible characters, signs or letters at any distances being a new application of that power of which I claim to be the first inventor or discoverer." Whether Morse actually invented the telegraph or any of the claims in his patent has historically been the subject of much debate, although that is not germane to the present discourse.

Furthermore, section 2106 (IV) of the MPEP, which directly addresses how to determine "whether the claimed invention complies with 35 USC §101" has as its first point: "*A.* Consider the Breadth of 35 USC 101 Under Controlling Law," a portion of which is reproduced below.

> As the Supreme Court has held, Congress chose the expansive language of 35 U.S.C. 101 so as to include "anything under the sun that is made by man." Diamond v. Chakrabarty, 447 U.S. 303, 308-09, 206 USPQ 193, 197 (1980). Accordingly, section 101 of title 35, United States Code, provides:
>
> > Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore, subject to the conditions and requirements of this title.
>
> In Chakrabarty, 447 U.S. at 308-309, 206 USPQ at 197, the court stated:
>
> In choosing such expansive terms as "manufacture" and "composition of matter," modified by the comprehensive "any," Congress plainly contemplated that the patent laws would be given wide scope. The relevant legislative history also supports a broad construction. The Patent Act of 1793, authored by Thomas Jefferson, defined statutory subject matter as "any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement [thereof]." Act of Feb. 21, 1793, ch. 11, § 1, 1 Stat. 318. The Act embodied Jefferson's philosophy that "ingenuity should receive a liberal encouragement." V Writings of Thomas Jefferson, at 75-76. See Graham v. John Deere Co., 383 U.S. 1, 7-10 (148 USPQ 459, 462-464) (1966).
>
> .... Thus, it is improper to read into section 101 limitations as to the subject matter that may be patented where the legislative history does not indicate that Congress clearly intended such limitations. Alappat, 33 F.3d at 1542, 31 USPQ2d at 1556.

The pending claims all relate to and claim different aspects of an improved finite element analysis or simulation. Independent claim 1 recites "performing a finite element simulation...;" independent claim 14 recites "A computer readable storage medium storing one or more computer programs for ...performing a finite element simulation...;" independent claim 25 recites "A computer system comprising... computer programs for performing a finite element simulation...;" independent claim 36 recites "A data signal embodied in a carrier wave, the data signal including one or more computer programs for performing a finite element simulation, the

computer programs comprising;" and independent claim 47 recites "A method for performing a finite element simulation..."

It is therefore not understood why the previous arguments provided to illustrate the *real world value* and *practical application* of finite element analysis were dismissed as hyperbole. Generally speaking, the utility of finite element analysis and simulation is that it reduces design time and allows engineers to design better products. It is a very practical "tool" for an engineer to have in the design process. This is why it is widely used in industry. It is not by any means simply a natural phenomena or abstract math as the Examiner asserts. Furthermore, as this is admittedly esoteric subject matter, Applicants have provided real word applications of the present invention within the application itself. Beginning on page 19 in a section entitled *Exemplary Applications,* usage of the claimed invention is described regarding design of two different "real world" reference parts.

FIGS. 4A and 4B show a timeline of a switching procedure that was automatically generated using a method of the present invention to solve a simulation of the formation of a Budd Complex Channel, which is a well known benchmark part. FIG. 4C shows the Budd Complex Channel that results from the simulation timeline shown in FIGS. 4A and 4B.

The text in the *Exemplary Applications* section regarding the Budd Complex Channel touches on the specific utility or *real world value* of the claimed present invention and a portion of that is reproduced below:

> For example, the automatic switching method produces a solution much faster than that which could be obtained using the manual switching procedure. Using the automatic switching method, the Budd Complex Channel simulation was completed in approximately 31 CPU hours on an IBM RS-6000/260 workstation computer. Using the manual switching procedure, a similar simulation was completed in approximately 27 CPU hours on the same computer. However, the trial-and-error process of determining the switching scheme for the manual method involved more than ten failed simulations. Thus the total simulation time using the manual switching method, including the trial-and-error process, was approximately ten times larger than the total simulation time using the automatic switching method. The cost savings measured in terms of man-hours required to conduct the simulation was even more significant, since the trial-and-error process required by the manual switching method was extremely labor intensive, and required an experienced operator, while the switching

procedure generated by the automatic switching method ran successfully on the first attempt without intervention by the operator.

Additionally, the automatic switching method produces a solution that is far more complex than that which could realistically be obtained using trial-and-error with the manual switching procedure. For example, the simulation of the Budd Complex channel using the automatic switching method involved fourteen switches between the implicit method and explicit method, while the manual switching scheme developed in over ten trial-and-error simulations included only three switches. FIG. 4D shows the switching scheme developed in the manual method, as compared to FIG. 4B for the automatic method. A complex solution using fourteen switches would have been virtually impossible to discover by trial-and-error using the manual switching procedure.

Page 21, line 17 to page 22 line 15.

Another example is also described and shown in FIG. 5A and 5B of the application. FIG. 5A shows a switching procedure that was automatically generated using a method of the present invention to solve a sheet metal springback simulation of the NUMISHEET '93 U-Channel part. FIG. 5B shows the NUMISHEET '93 U-Channel part immediately after stamping (shaded portion) and after springback has occurred (unshaded portion).

The text of this example illustrated in the application is reproduced below in evidence of the real world value of the present invention.

FIG. 5A shows a switching procedure that was automatically created using method 300 to solve a sheet metal springback simulation of the NUMISHEET '93 U-Channel part. Springback is a problem that occurs when a stamped metal part is removed from formation tooling, and the part changes shape or deforms as internal stresses are relieved. Deformation due to springback creates a final part which no longer matches the shape of the tooling with which it was produced and, thus, is undesirable. Sheet metal parts which exhibit a large amount of deformation due to springback are typically very flexible. These types of parts are particularly challenging for the implicit method, and convergence of the equilibrium iteration process is inherently difficult. Thus, the implicit-explicit switch is ideally suited for springback simulation.

Referring to FIG. 5A, the y-axis (time step size) indicates which simulation method is employed: The implicit method uses a large time step (1.0 to 2.0 milliseconds), whereas the explicit method uses a small time step (9.0×10^{-4} milliseconds). During the simulation, the implicit method ran successfully during the first four time steps, but encountered convergence difficulty on the fifth time step. The fifth time step was an attempt advanced the solution to the original simulation end time of 10.0 milliseconds. The convergence failure was detected by method 300, and the explicit method was automatically activated for a duration

of 1.0 milliseconds. Then the method 200 automatically switched back to the implicit method, and another implicit step was attempted. This step failed to converge also, so method 300 switched back to the explicit method and advanced the solution for a duration of 1.0 ms.

At this point the solution reached the original simulation end time, but since the current solution method was not implicit, method 300 automatically extended the end time by 1.0 milliseconds before switching back to the implicit method. This extension of the solution end time ensures that the last step of the simulation will be performed with the implicit method, and represents the fundamental difference between method 200 and method 300.

Several more automatic switches to the explicit method were performed, each for a duration of approximately 1.0 milliseconds, and each time returning to test for convergence with the implicit method. After a total of 31 switches, the part deformation had proceeded dynamically to a state which was close enough to the static equilibrium solution that the implicit method could finally converge, and the solution finished successfully.

The shaded portion of FIG. 5B shows the NUMISHEET '93 U-Channel part immediately after stamping or forming. The part geometry immediately after stamping includes four 90-degree angles θ1, θ2, θ3, and θ4, a horizontal center section 502, vertical sidewalls 503 and 504, and horizontal flanges 505 and 506. The unshaded portion of FIG. 5C shows the NUMISHEET '93 U-Channel part of FIG. 5B after springback has occurred (as simulated). After springback, θ1 is now less than 90 degrees, θ2 and θ3 are greater than 90 degrees, and θ4 is less than 90 degrees.

Page 22, line 16 to page 24 line 7.

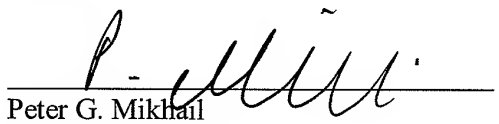
As can be seen through these examples in the specification, the automatic implicit-explicit switching method is a robust, automatic procedure which can obtain solutions which are very accurate and can be obtained with minimal operator interaction. Conventional simulation techniques often could not produce an accurate solution and required significant operator interaction.

Both the conventional finite element techniques in the prior art that can be seen in numerous issued US patents, as well as the techniques disclosed and claimed in the present application are eligible subject matter of the type the patent laws are meant to encompass.

Conclusion

Accordingly, it is believed that this application is now in condition for allowance and an early indication of its allowance is solicited. However, if the Examiner has any further matters that need to be resolved, a telephone call to the undersigned attorney at 415-318-1168 would be appreciated.

Respectfully submitted,



August 4, 2006
Date

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